

BELLCOMM. INC.

1100 Seventeenth Street, N.W. Washington, D.C. 20036

SUBJECT: Safety-Rescue Escape APO
Briefing - Case 320**DATE:** July 18, 1968**FROM:** G. B. TrousoffMEMORANDUM FOR FILE

The attached charts were prepared to review the history and status of Safety-Rescue-Escape as related to NASA Manned Space Flight programs.

The charts numbered 1 through 11 were used in an APO (Action Center) briefing on July 15, 1968. Charts A through D were prepared for possible use in a follow-on presentation to Dr. G. E. Mueller. The follow-on presentation was cancelled and General S. C. Phillips was provided with two complete sets of charts for use in discussions with Dr. Mueller.

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G. B. Trousoff
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Attachments

(NASA-CR-73538) SAFETY-RESCUE ESCAPE APO
BRIEFING (Bellcomm, Inc.) 16 p**N79-72193**00/16 **Unclas**
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SAFETY-RESCUE-ESCAPE
(AS IT RELATES TO APOLLO)

- **BACKGROUND**
- **EMERGENCIES vs. PREVENTIVE AND REMEDIAL MEASURES**
- **APOLLO PROGRAM STATUS AND ACTIONS**

TERMINOLOGY

- FLIGHT SAFETY ◦ INDUSTRIAL SAFETY ◦ PUBLIC SAFETY
- SYSTEM SAFETY (RISK MANAGEMENT)
- EFFECTIVE ENGINEERING, DESIGN AND PROGRAM MANAGEMENT
- RESCUE, ESCAPE
- SPACE FLIGHT EMERGENCIES
- SPACE FLIGHT SAFETY
- PREVENTIVE SAFETY MEASURES ◦ REMEDIAL SAFETY MEASURES

HISTORIC SUMMARY

<u>PERIOD</u>	<u>PRINCIPAL ACTIVITIES AND STATUS</u>	<u>NASA STATEMENTS</u>
PRIOR TO 11/65	HOLDING ACTION EMPHASIS ON PREVENTION - DEVELOP CAPABILITY LATER BELLCOMM STUDY OF APOLLO RESCUE CAPABILITY MARTIN COMPANY PROPOSAL USAF/AEROSPACE STUDY (ESCAPE)	FROM MR. WEBB TO THE PRESIDENT (6/2/65) OMSF STAFF PAPER (10/4/65)
11/65-2/66	ASSIGNED TO AAP BELLCOMM STUDY FURTHER EFFORT DEFERRED USAF AND MSC FOR "ESCAPE" PSAC AND BoB QUESTIONS	MSF STAFF PAPER (2/24/66) REPLIES TO BoB & PSAC
3/66 -	ASSIGNED TO MT (MY) STUDIES BY RAND, AEROSPACE, GE, MSC, LOCKHEED TEAGUE SURVEY APOLLO ACCIDENT INVESTIGATION - AUGMENTED SAFETY ORGANIZATION (SYSTEM SAFETY) "5 YEAR" PROGRAM	REPLY TO TEAGUE QUESTIONNAIRE (1/4/67) MSF SAFETY PROGRAM (TEAGUE) (PAPER ON APOLLO RESCUE- ESCAPE STATUS) (PROGRESS REPORT TO TEAGUE)

STATEMENT ON SPACE FLIGHT SAFETY PROGRAM OBJECTIVES*

THE NASA MANNED SPACE FLIGHT SAFETY PROGRAM IS DESIGNED TO IDENTIFY, EVALUATE AND MANAGE RISK ACROSS THE ENTIRE SCOPE OF MANNED SPACE FLIGHT OPERATIONS SO AS TO ACHIEVE AN ALLOCATION OF PROGRAM RESOURCES AND VEHICLE CAPABILITIES THAT MINIMIZES THE TOTAL RISK TO OUR ASTRONAUTS, AND, AT THE SAME TIME, PERMITS DELIBERATE AND STEADY PROGRESS TOWARD OUR SPACE PROGRAM GOALS. THIS PROGRAM IS PURSUED ALONG THREE BROAD FRONTS AS FOLLOWS:

SAFETY AND PROGRESS

USE BEST AVAILABLE TECHNIQUES IN EACH PROGRAM

1. IN EACH MANNED NASA PROGRAM, NASA WILL INCORPORATE THE COMBINATION OF INHERENT EQUIPMENT RELIABILITY AND REDUNDANCY, AS WELL AS PROVEN EMERGENCY TECHNIQUES OR PROCEDURES THAT MOST EFFECTIVELY PREVENTS THE LOSS OF ANY CRITICAL MISSION FUNCTIONS AND PREVENTS OR CONTAINS POSSIBLE CATASTROPHIC FAILURES.

BUILD RESERVOIR OF TECHNIQUES

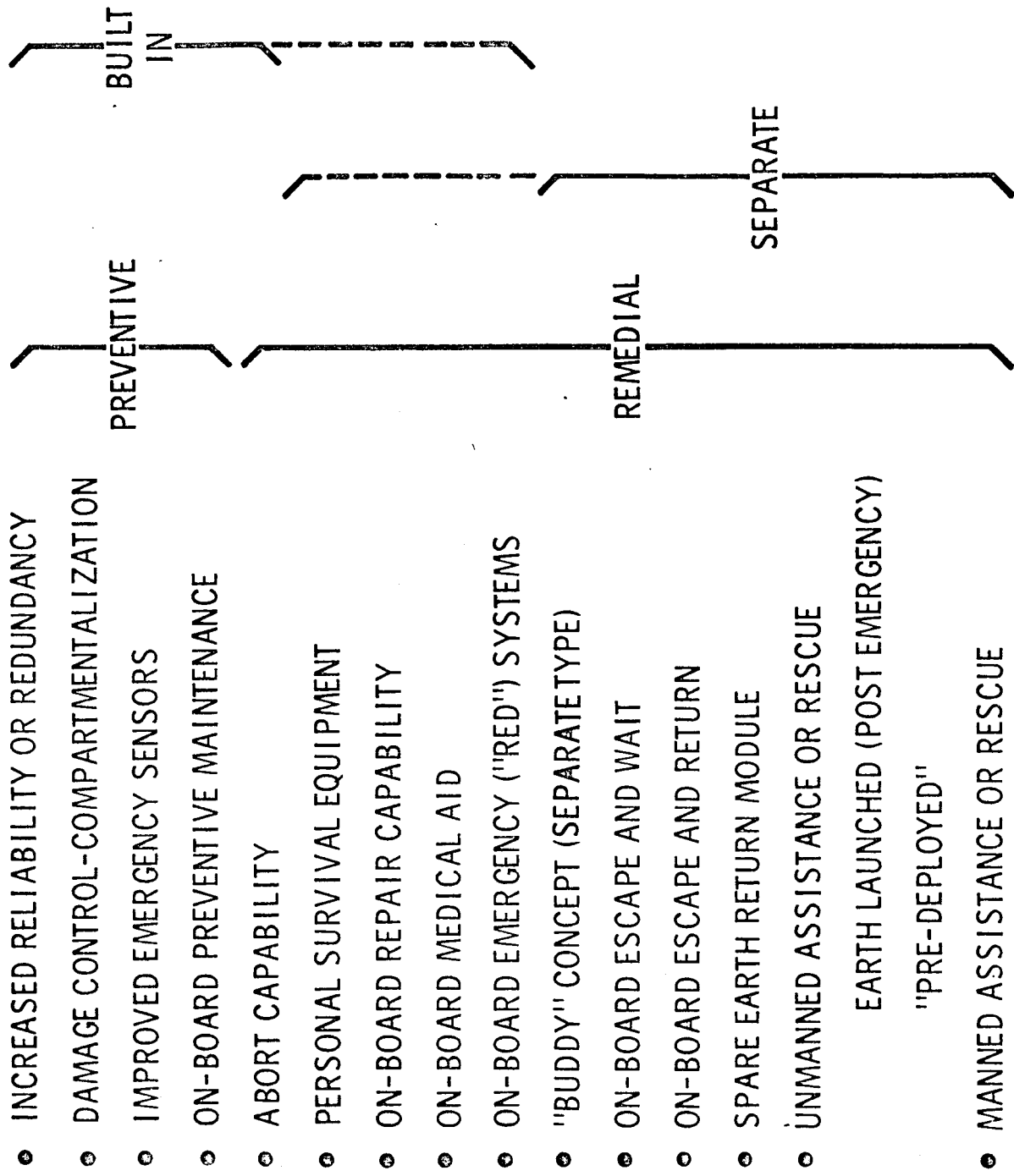
2. NASA WILL IDENTIFY AND DEVELOP NEW SYSTEMS, DEVICES, CONCEPTS AND PROCEDURES TO PREVENT OR COPE WITH SPACE FLIGHT EMERGENCIES IN A MANNER, AND ON A SCHEDULE, THAT FACILITATES THEIR TIMELY INCORPORATION IN OUR PLANNED MANNED PROGRAMS.

COOPERATE AMONG PROGRAMS

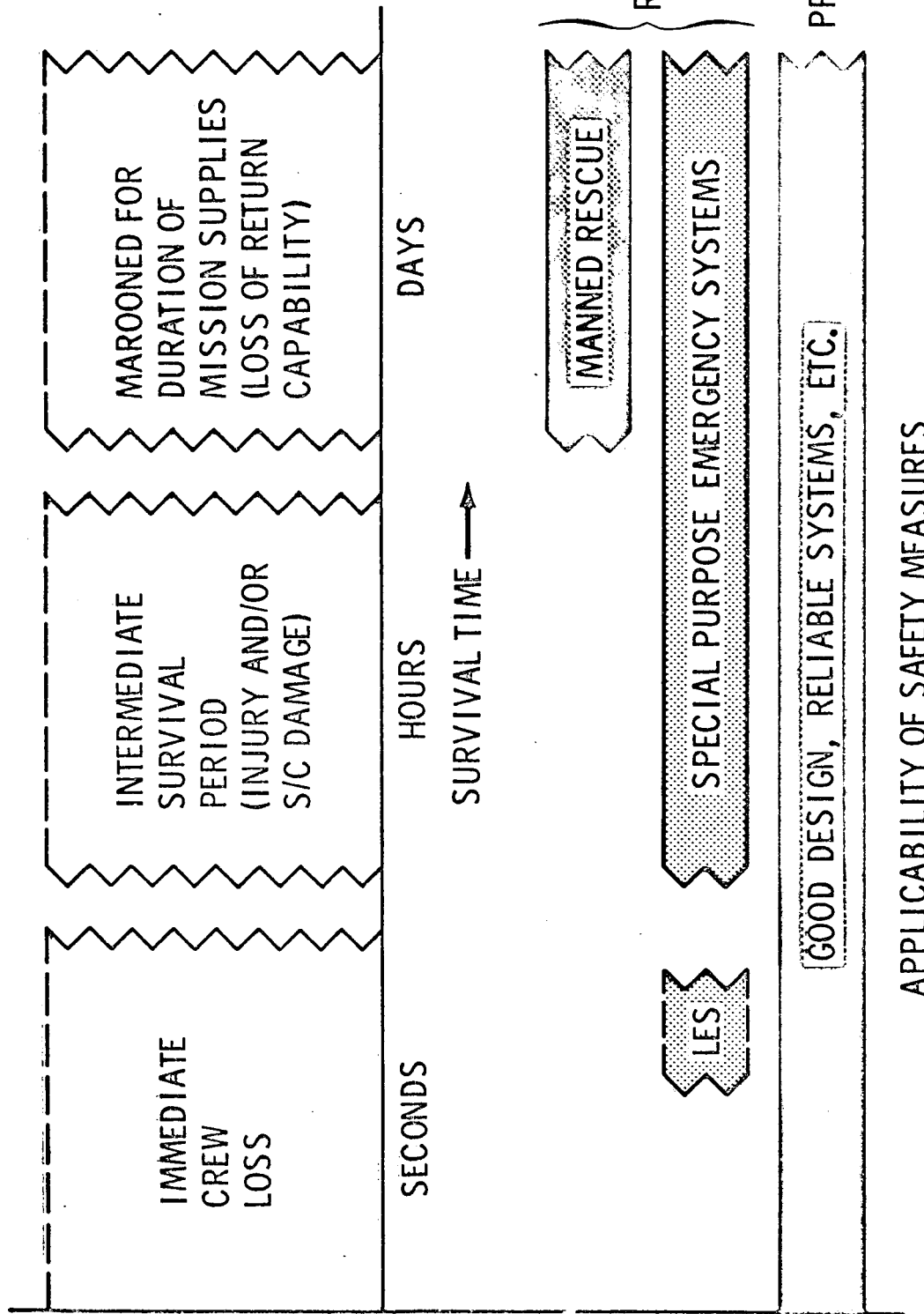
3. NASA WILL CONTINUE TO CONDUCT SUPPORTING STUDIES, TO IDENTIFY NEW CONCEPTS, TECHNOLOGIES AND REQUIREMENTS AND TO COORDINATE SAFETY ACTIVITIES AMONG PROGRAMS SO AS TO INSURE A GROWING CAPABILITY TO PROVIDE SPACE FLIGHT EMERGENCY AID OR RESCUE.

*DERIVED FROM "RESUME OF THE NASA MANNED SPACE FLIGHT SAFETY PROGRAM" (5/21/68)

CONCEPTS TO COUNTER SPACE FLIGHT EMERGENCIES



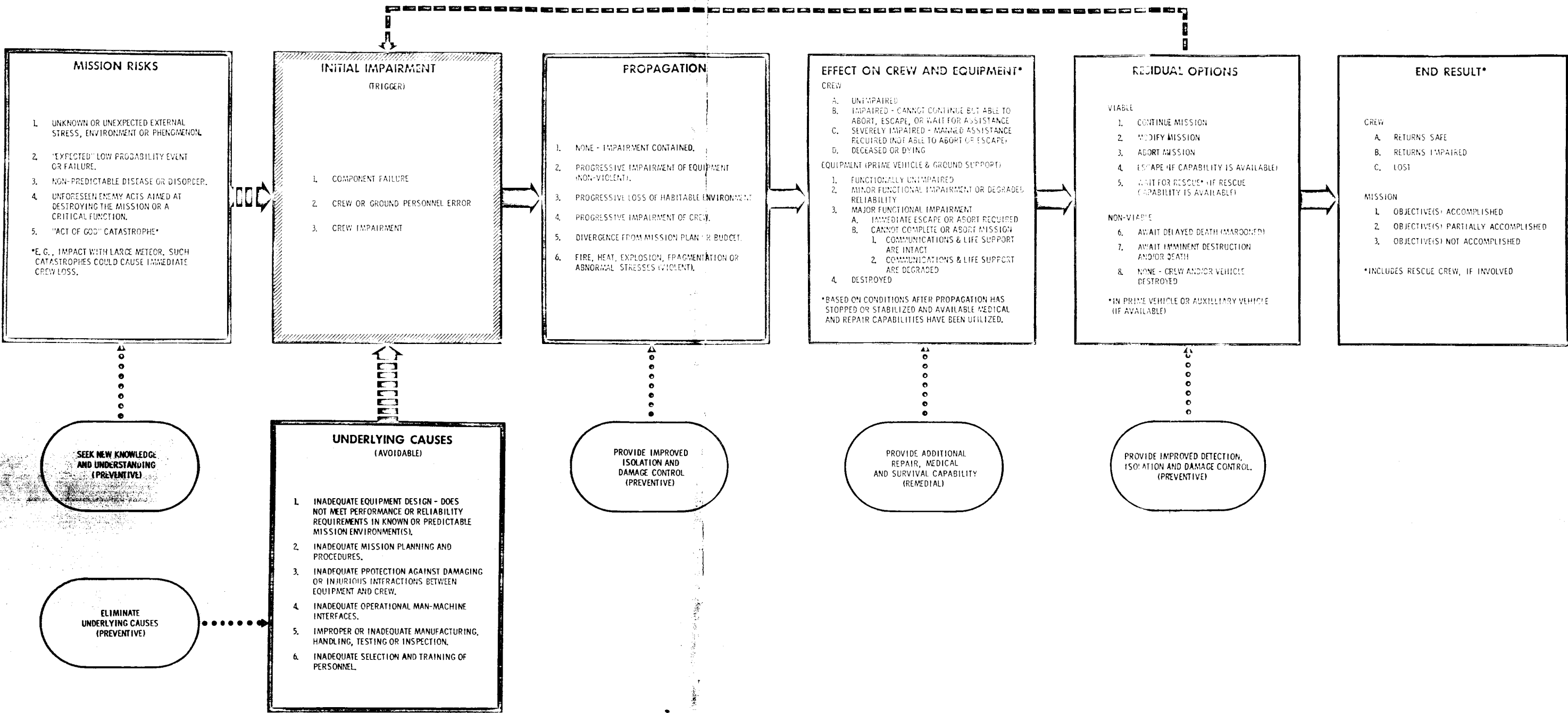
EMERGENCIES - SAFETY MEASURES



VIEWPOINTS AND ARGUMENTS

- LIVES SAVED vs. PUBLIC IMAGE
- IT IS BETTER TO HAVE TRIED
- EXPLORATION vs. EXPLOITATION
- RISK ASSUMED BY RESCUE CREW
- PARTIAL vs. 100% COVERAGE - RESCUE OF OPPORTUNITY
- MANY SPECIALIZED DEVICES vs. UNIVERSALLY APPLICABLE SYSTEM
- CONTINUOUS COST/RISK vs. AFTER EMERGENCY COST/RISK
- EARLY IMPLEMENTATION vs. BY-PRODUCT OF INCREASED TRAFFIC & PAYLOAD CAPABILITY
- PREVENTIVE vs. REMEDIAL ACTIONS
- IN MODULE - IN PROGRAM - ACROSS PROGRAMS (USAF, USSR?)
- TOO LATE OR TOO EARLY

THE ELEMENTS OF A MANNED SPACE FLIGHT EMERGENCY



APOLLO PROGRAM

- SAFETY MEASURES INCORPORATED

PREVENTIVE (RELIABILITY, REDUNDANCY, ETC.)

REMEDIAL (LES, SLIDE WIRE, SPS ABORT, FREE RETURN, ETC.)

- SAFETY MEASURES CONSIDERED BUT NOT INCORPORATED

FULL COVERAGE RESCUE (SAT V)

SPECIAL PURPOSE EMERGENCY SYSTEMS

ORBITAL ESCAPE DEVICE

LUNAR SURFACE ESCAPE VEHICLE

PRE-DEPLOYED LM

EARTH ORBIT RESCUE

PROPOSED APOLLO PROGRAM POSITION

- CONTINUE INTENSE EFFORT BY LINE AND AUGMENTED SAFETY ORGANIZATIONS TO
 - IMPROVE RELIABILITY AND PERFORMANCE MARGINS
 - IDENTIFY HAZARDS, SFP'S AND RESOLVE (RISK MANAGEMENT)
 - VALIDATE MISSION OPERATIONS, AND ABORT CAPABILITIES
 - PERFORM SYSTEMATIC FLIGHT SAFETY REVIEWS
 - MAINTAIN HIGH PROGRAM DISCIPLINE AND "MANNED FLIGHT AWARENESS"
- CONTINUE TO PLACE PRIME RELIANCE ON PREVENTIVE MEASURES
- USE FEASIBLE REMEDIAL SYSTEMS FOR SELECTED RISKS
- CONSIDER IMPLEMENTATION OF RESCUE AND ESCAPE FOR PROGRAMS BEYOND PRESENT APOLLO

PREREQUISITIES FOR RESCUE

- ADEQUATE SURVIVAL CAPABILITY AT RESCUE SITE
- COMMUNICATIONS WITH RESCUE SITE
- QUICK REACTION LAUNCH CAPABILITY
- "REAL TIME" MISSION PLANNING CAPABILITY
- PAYLOAD CAPABILITY, ΔV FOR RENDEZVOUS, SPACE FOR EXTRA CREW
- CAPABILITY TO OPERATE WITH REDUCED CREW AND WITH EXTRA CREW
- CAPABILITY TO EFFECT CREW TRANSFER (DOCKED OR EVA)

THE CASE FOR PARTIAL RESCUE COVERAGE ON WORKSHOP PROGRAMS

- SPARE ERM
 - REQUIRES USE OF ONE VEHICLE PER WORKSHOP
 - COUNTERS PART OF HAZARD SPECTRUM (VULNERABLE TO DAMAGE)
 - WITHIN STATE OF ART
- ESCAPE DEVICE
 - REQUIRES R & D + TEST
 - COUNTERS PART OF HAZARD SPECTRUM (VULNERABLE TO DAMAGE)
 - RISKY OPERATION
 - SOME PAYLOAD PENALTY
- EARTH BASED RESCUE
 - REQUIRES COMMITMENT (NOT NECESSARILY USE) OF ONE VEHICLE PER GROUP OF PROGRAMS
 - SIMILAR TO RESUPPLY VEHICLE
 - CAN BE AN ADVANCED RESUPPLY MISSION (ROTATED INTO PROGRAM)
 - COUNTERS PART OF HAZARD SPECTRUM-PROVIDES MANNED ASSISTANCE
(EFFECTIVENESS DIFFICULT TO EVALUATE - EXISTING STUDIES ARE NEGATIVE)
 - PARTIAL COVERAGE COULD BE IMPLEMENTED AT EARLY DATE
 - NO MISSION PAYLOAD DRAIN
 - ACCIDENT INVESTIGATION - RETRIEVAL CAPABILITY
 - IMPLEMENTATION MAINLY A MATTER OF "MISSION ASSIGNMENTS" AND KSC SCHEDULING

PROPOSED POSITION FOR WORKSHOP PROGRAM

CONTINUE APOLLO APPROACH

ADOPT A POSITIVE ATTITUDE TOWARD DEVELOPMENT AND INCORPORATION
OF IDENTIFIED EMERGENCY SYSTEMS OR FEATURES SUCH AS

- COMPARTMENTALIZATION FOR DAMAGE CONTROL
- SPARE ERM OR ESCAPE DEVICE
- PARTIAL EARTH BASED RESCUE COVERAGE USING RESUPPLY SYSTEMS

LOOK ACROSS ALL MSF (AND USAF) PROGRAMS FOR POTENTIAL FOR MUTUAL
EMERGENCY AID

PROPOSED LUNAR EXPLORATION PROGRAM POSITION

- CONTINUE APOLLO APPROACH
- CONSIDER:
 - INCREASE IN LUNAR SURFACE AND ORBIT STAYTIME MARGINS
(FOR REPAIR AND FUTURE RESCUE)
 - ASCENT BACK UP (LSEV)
(COUNTERS PART OF HAZARD SPECTRUM)
 - SURFACE EXPLORATION HAZARDS AND SURVIVAL/RESCUE CAPABILITY
 - SM BACK UP
- WORK TOWARD PRE-REQUISITES FOR RESCUE CAPABILITY

BELLCOMM, INC.

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From: G. B. Trousoff

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